Remotely Piloted Aircraft Systems Guideline

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Summary of Changes		
Date Revised	Sections (if applicable)	Description of Change
October 28, 2024	All	Put into new guideline template; updated addresses; updated definitions, acronyms and bibliography; updated references to regulations and removed duplication with other guidelines.

Foreword

The Canada-Nova Scotia Offshore Petroleum Board and Canada-Newfoundland and Labrador Offshore Petroleum Board (the *Regulators*) have issued this Guideline to assist operators who intend to use Remotely Piloted Aircraft Systems with respect to all petroleum-related works and activities conducted in the *Offshore Area.*

Guidelines are developed to provide assistance to those with statutory responsibilities (including operators, employers, employees, supervisors, providers of services, suppliers, etc.) under the *Accord Acts* and regulations. Guidelines provide an understanding of how legislative requirements can be met. In certain cases, the goals, objectives and requirements of the legislation are such that no guidance is necessary. In other instances, guidelines will identify a way in which regulatory compliance can be achieved.

The authority to issue Guidelines and Interpretation Notes with respect to legislation is specified by sections 151.1 and 205.067 of the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Act, S.C. 1987, c.3 (C-NLAAIA),* sections 147 and 201.64 of the *Canada-Newfoundland and Labrador Atlantic Accord Implementation Newfoundland and Labrador Act,* RSNL 1990 c. C-2*,* subsection 156(1) and section 210.068 of the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act, S.C. 1988, c.28 (CNSOPRAIA)* and section 148 and subsection 202BQ(1) of the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act.* The *Accord Acts* also state that Guidelines and Interpretation Notes are not deemed to be statutory instruments.

For the purposes of this Guideline, these Acts are referred to collectively as the *Accord Acts*. Any references to the C-NLAAIA, the CNSOPRAIA or to the regulations in this Guideline are to the federal versions of the *Accord Acts* and the associated regulations.

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1.0 Acronyms and Abbreviations

CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CAR	*Canadian Aviation Regulations*
C-NLAAIA[1]	*Canada-Newfoundland and Labrador Atlantic Accord Implementation Act*
C-NLOPB	Canada-Newfoundland and Labrador Offshore Petroleum Board
CNSOPB	Canada-Nova Scotia Offshore Petroleum Board
CNSOPRAIA[2]	*Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act*
GPS	Global Positioning System
HLO	Helicopter Landing Officer
HSE	Health, Safety and Environment
IOGP	International Association of Oil and Gas Producers
ISO	International Organization for Standardization
NAV Canada	Canada's civil air navigation service
NL	Newfoundland and Labrador
OIM	Offshore Installation Manager
PIC	Pilot in Command
RPAS	Remotely Piloted Aircraft Systems
RVT	Remote Viewing Terminal
TCA	Transport Canada Aviation
TDG	Transportation of Dangerous Goods
VLOS	Visual Line-of-Sight

[1] References to the C-NLAAIA in this Guideline are to the federal version of the *Accord Act*
[2] References to the CNSOPRAIA in this Guideline are to the federal version of the *Accord Act*

VMC	Visual Meteorological Conditions

2.0 Definitions

In this Guideline, the terms such as “operator”, “provider of service” (referred to as service provider within this Guideline), “workplace” and “workplace committee” referenced herein have the same meaning as in the *Accord Acts*.

In this Guideline, the terms such as “certifying authority”, “installation”, “reportable incident” and “support craft” referenced herein have the same meaning as in the *Framework Regulations.*

In this Guideline, the terms such as “crew member”, “remotely piloted aircraft”, “remotely piloted aircraft system or RPAS” and “visual meteorological conditions”, referenced herein have the same meaning as in the *Aeronautics Act* and *Canadian Aviation Regulations*.

For the purposes of this Guideline, the following terms have been capitalized and italicized when used throughout. The following definitions apply:

Accord Acts	means the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act*, the *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act*, the *Canada-Newfoundland Atlantic Accord Implementation Act* and the *Canada-Newfoundland and Labrador Atlantic Accord Implementation (Newfoundland and Labrador) Act*
Command and Control Link	means the data link (i.e., C2 link) between the RPAS and the remote pilot station for the purposes of managing the flight
Control Station	means the facilities or equipment that remotely control and monitor the RPAS
De-confliction	means reducing the risk of collision between aircraft by coordinating their movements
Drone	means any type of RPAS or Unmanned Aircraft System (UAS)
Flight Safety	means the state in which risks associated with aviation activities, related to, or in direct support of the operation of aircraft, are reduced and controlled to an acceptable level
Framework Regulations	means the *Canada-Newfoundland and Labrador Offshore Area Petroleum Operations Framework Regulations, SOR/2024-25* and the *Canada-Nova Scotia Offshore Area Petroleum Operations Framework Regulations, SOR/2024-26*

Human Factors	means the environmental, organizational and job factors, and human and individual characteristics, which influence behaviour at work in a way that can affect HSE.
Offshore Area	means an offshore area as defined by the *Accord Acts*
OHS Regulations	means the *Canada-Newfoundland and Labrador Offshore Area Occupational Health and Safety Regulations, SOR/2021-247* or the *Canada-Nova Scotia Offshore Area Occupational Health and Safety Regulations, SOR/2021-248*
Payload	means a system, object or collection of objects that is onboard or is otherwise connected to a RPAS but is not required for flight.
Pilot in Command	means the person who has final authority and responsibility for the operation and safety of flight, has been designated as PIC before or during the flight, and holds the appropriate certificate for the conduct of the flight. The PIC position may rotate duties as necessary with equally qualified pilots. The individual designated as PIC may change during flight. The PIC can be the PIC for one aircraft at a time. The PIC should meet TCA requirements for training, certification and medicals.
Regulator	means the Canada-Newfoundland and Labrador Offshore Petroleum Board or the Canada-Nova Scotia Offshore Petroleum Board, as the case may be
Team Member	means an individual who forms part of the RPAS team, including RPAS pilots, RPAS service provider and designated members of the installation or vessel, if applicable.

3.0 Purpose and Scope

The purpose of this Guideline is to assist operators who intend to use RPAS to conduct certain activities in the *Offshore Area* in understanding the risks and the requirements for using these types of systems.

4.0 Usage of RPAS

RPAS is constantly evolving to assist with survey, inspection and maintenance of installations (attended or unattended) or vessels in the *Offshore Area*. There are numerous types of RPAS operations that can be completed in an offshore environment. These typically include:

- Aerial photography/survey/security which typically involves flying in an open space, away from structures.
- Inspections which normally involve flying close to, inside or under structures in order to get detailed imagery or data. Typical areas that are accessed by RPAS include:
  - Flare towers, derricks and other elevated structures
  - Flare booms
  - Live flare tips
  - Turbine generator exhausts
  - Cranes
  - Helideck support structures
  - Under deck/splash zone
  - Risers/caissons
  - Vessel hulls
  - Accommodation blocks
  - Antenna farms
  - Inside of tanks

If the equipment or procedures are to be used at a workplace, or if personnel are to be present at the workplace, they are also subject to any requirements of the *OHS Regulations*. Guidance for these regulations is provided in the *Guideline for the OHS Regulations.*

The usage of RPAS should be described as part of the scope of an application for authorization. Refer to the guidance on scope provided in the *Guideline for Petroleum-Related Authorizations and Approvals* (in NL) and the associated *Guideline for the Framework Regulations*. The risk assessment and associated measures for using RPAS, a description of RPAS and the associated control and monitoring systems, *Team Members* and associated procedures for using RPAS should all be described in the Safety Plan. Refer to the *Safety Plan Guideline* for guidance. In addition, emergency procedures should be described in the Contingency Plan as described in the *Contingency Plan Guideline*.

As part of its Declaration of Fitness issued pursuant to the *Accord Acts*, the operator must review, understand and accept the equipment, procedures and training (including all crew member qualifications and experience) in place for operations with an RPAS. Operators should undertake any activities necessary prior to contracting a service provider to conduct offshore RPAS operations, including a detailed operational/*Flight Safety*/commercial audit. These reviews should be

performed by an aviation subject matter expert appointed by the operator and aviation safety audits should be carried out by qualified and competent auditors using the processes set out in Part IX of the CAR. RPAS used to conduct advanced operations, as per Part IX of the CAR, should be declared to the Regulator and to Transport Canada, as required, as able to perform certain advanced operations safely. This should include the RPAS Safety Assurance categories for flights in controlled airspace, flights near people, flights over people and flights in the vicinity of airports (which, in the *Offshore Area*, would include any associated aircraft landing areas). For more information on how RPAS Safety Assurance affects where and how pilots can fly an RPAS, refer to *Choosing the Right Drone for Advanced Operations*, *Transport Canada Advisory Circular (AC) 922-001: Remotely Piloted Aircraft Systems Safety Assurance* and *Transport Canada Standard 922- RPAS Safety Assurance – Canadian Aviation Regulations.*

All requirements of the *Aeronautics Act*, CAR and TCA with respect to RPAS must be complied with, including:

- Rules specified in the CAR Part IX.
- Requirements for certification of RPAS pilots (e.g., valid Advanced Operations Pilot Certificate)
- Requirements for registration for RPAS for advanced operations (e.g., appropriately safety assured, registered with TCA and marked with the applicable registration number).
- Requirements for using RPAS outside of the rules established by TCA (e.g., section 903.01 of the CAR requirements to obtain a Special Flight Operations Certificate as referred to in *Getting Permission to Fly a Drone Outside the Rules*. Some examples of where this certificate would be required include:
  - Weight over 25 kg
  - Carrying dangerous or hazardous *Payloads* (e.g., chemicals) on the RPAS

If the RPAS is planned to be used onboard a production, drilling or accommodation installation, the certifying authority of that installation should also be engaged pursuant to subsection 162(1) of the *Framework Regulations* as this equipment may have an impact on the safety of that installation.

5.0 General Considerations

A program or project which involves the use of an RPAS should take the following into consideration:

5.1 Normal Operating Procedures

Normal operating procedures for RPAS should be in place that are routinely kept up to date, approved by the RPAS company accountable manager and include:

- Required equipment and personnel
- Roles and responsibilities of personnel
- List of authorized operations
- Permit to work system
- Securing the airspace
- Take-off and landing sites
- Airborne procedures including details of flight paths and no fly zones
- Communications protocol
- Site specific risk assessment
- Description of operational controls
- Operational procedures for adverse weather
- Use of first person viewing systems
- Site survey process

Procedures should also address the following:

- Transportation and safe handling of lithium batteries.
- Restricted access to areas with hazardous atmospheres identified and appropriate mitigation measures in place.
- Restricted access to areas of known or potential magnetic or radio wave interference identified and appropriate mitigation measures in place.
- Overfly, security and privacy restrictions identified and mitigated for operations adjacent to assets and people on and offshore (i.e., no overflight of personnel).
- RPAS pilot training and certification (including proof of passing TC RPAS exam (or equivalent) and advanced operations pilot certificate.
- Reference to inspection, testing and maintenance procedures, including RPAS system servicing and maintenance as per original equipment manufacturer recommendations.
- Document control and record keeping procedures, including those for maintenance and flight records.
- Training and competency management procedures, including description of competency and training in the following:
  - Normal and emergency procedures (including loss of *Command and Control Link*)
  - Loss of visual contact
  - Fly-away[3]
  - Flight control failure
  - Flight termination process
  - Pilot incapacitation
  - Procedures specific to operating offshore, including failsafe configuration
- Company-specific description of HSE procedures that may be more stringent than required by the operator, such as those in relation to:

[3] means, in respect of RPAS, an interruption or loss of the *Command and Control Link* such that the pilot is no longer able to control the aircraft, and the aircraft no longer follows its preprogrammed procedures or operates in a predictable or planned manner.

- Crew duty time
- Hazard and near miss reporting
- Medicals
- Drug and alcohol usage and testing

Additional guidance is provided in *Oil and Gas UK Unmanned Aircraft Systems Operations for Offshore Installations.* Additional guidance for an operations manual for RPAS is included in Appendix B of this document.

5.2 Emergency Operating Procedures

Emergency response procedures should be in place for all RPAS flight operations and take into consideration all requirements of Part IX of the CAR. These procedures should be referenced in the Contingency Plan and include an approved incident response checklist which can be followed in the event of an incident. The RPAS team should also receive an orientation of the facility and be familiarized with the facility's emergency response plan and their associated actions in response to an emergency. Emergency response procedures should include the following:

- List of emergency contacts
- Fire and gas alarms/release response procedures
- Blowdown/increased flare rate response procedures
- RPAS operational upset conditions
- Contingency procedures for:
  - Prop/rotor failure
  - Loss of *Payload*/dropped objects
  - Battery failure
  - Loss of communications link/cyber interference
  - Magnetic disturbances and anomalies
  - Log file recording

Incidents should be reported immediately by the RPAS pilot to the OIM (or vessel master) or delegate. For reporting of events and incidents, refer to the *Incident Reporting and Investigation Guideline,* which provides guidance on the types of incidents to report and reporting to the *Regulators*, workplace committee and other authorities.

6.0 Considerations for use Offshore

A program or project which involves the use of an RPAS should take the following into consideration:

6.1 Roles and Responsibilities

6.1.1. Installation or Vessel

The OIM (or vessel master) is responsible for all activities undertaken on an installation or vessel. This includes ensuring that all conflicting/simultaneous RPAS operations have been properly risk assessed, robust procedures are in place and trained and competent crew members are assigned to manage the RPAS activities.

The day-to-day delegated responsibilities should normally include:

- The OIM (or vessel master) or delegate should be the single point of contact to manage all RPAS operations on and around the installation or vessel.
- The OIM (or vessel master) or delegate onboard the installation or vessel will appoint a nominated person as a single point of contact to manage the permit to work system on behalf of the RPAS team.
- Another person, such as the HLO (or an alternate nominated responsible person), should provide direct communications to the RPAS team regarding ongoing operations onboard the installation or vessel and should also act as an additional visual observer for flight operations on and around the installation or vessel. This would include communications from the control room, bridge, etc.

6.1.2. RPAS Crew Members

All of the RPAS activities should be overseen remotely by the RPAS service provider's project manager who supports the RPAS team with assignment preparation, operations and assignment of post operations duties. This person should also act as the operator liaison.

6.2 Coordination of Work

RPAS operations should be conducted in accordance with the installation or vessel permit to work system to ensure control and coordination. Should the RPAS be operated in close proximity to radar antennas on an installation or vessel, those antenna systems should be placed in standby and radar monitoring should be provided by attendant support craft. This operational mode is critical to the *Flight Safety* of the RPAS, and failure to do so can cause significant interference between the RPAS and the *Command and Control Link*. This

interference can include navigation and weather radar, as well as radar used for tanker management.

RPAS crew members should attend shift handover meetings onboard the installation or vessel.

6.3 Communication

Communications between the RPAS team and installation supervisory personnel onboard the installation or vessel should be established as part of pre-job planning and adhered to at all times throughout the RPAS operations. A formal means of communication between the RPAS pilot and *Payload* specialist should be established, as well as communication between the RPAS pilot and the installation or vessel (e.g., radio room, central control room or bridge). Communications between the RPAS pilot and installation or vessel may also be controlled by the RPAS observer.

6.4 Familiarization with the Facility and Associated Hazards

Prior to undertaking any RPAS activities on or near an installation or vessel, the RPAS team, assisted by the operator, should familiarize themselves with the layout, topography, processes, hazardous areas and types of upsets or emergencies that may occur. Focus should be on ensuring that the planned RPAS operations can be safely managed without interference or without jeopardizing other onboard operations. This familiarization should occur prior to completing the formal hazard identification and risk assessment for the activity, as risks and hazards may be identified by the RPAS crew that would not typically be identified by the operator and vice versa.

6.5 De-confliction with Other Aircraft Operations

Procedures should be in place to ensure that adequate helicopter (and fixed-wing aircraft, when applicable) *De-confliction* is factored into the RPAS flight program. As a minimum, the RPAS should be on deck and stowed no less than 30 minutes prior to aircraft arrival and 30 minutes after its departure.

Prior to planned RPAS operations on an installation or vessel, the HLO (or delegated responsible person) should ensure that the schedule for RPAS operations is communicated (e.g., during shift handovers) to all relevant personnel. Aircraft service providers, air traffic control and flight crews should also be made fully aware of planned RPAS operations during daily flight planning to the installation or vessel and to nearby facilities within the area of operations of the RPAS.

Updates on the status of RPAS operations should be communicated to flight crews by the HLO or radio operator during the approach phase of the flight, with continual updates being provided throughout.

6.6 De-confliction with Marine Operations

Procedures should be in place to ensure that adequate *De-confliction* with support craft or other installations or vessels in close proximity is effectively achieved. Standby and other installations or vessels working in close proximity to the installation or vessel (e.g., supply vessels, tankers, diving vessels) should be made aware of ongoing RPAS operations by the radio operator. The other facilities in close proximity should also maintain a listening watch. The flight routes of the RPAS should be such that they avoid flying over or directly alongside any installation or vessel in the area. Similarly, *De-confliction* with any concurrent crane activities or the movement of other equipment that can interfere with the RPAS operation (e.g., derrick moves, turret rotations) is also critical.

6.7 Flight Planning, Conduct and Surveillance

The RPAS flight team should conduct a pre-operations briefing for each day's activities that details, which includes the planned flight schedule, the designated take off/landing area(s), location weather forecast (including motion conditions for the installation or vessel, as applicable), intended areas of RPAS activity, no-fly zones (as determined during the hazard and risk assessment) and potential installation operating effects on the RPAS program (e.g., turbulence and thermal effects from turbine exhausts, vents, areas of potential radio-frequency or magnetic interference, GPS-denied areas, potential ignition sources).

The RPAS crew should verify that they have reviewed the RPAS maintenance records to ensure that pre-flight and periodic inspections are up to date and the RPAS is airworthy in all respects.

7.0 Specific Considerations for RPAS

A program or project which involves the use of an RPAS should take the following into consideration:

7.1 Operating Requirements and Authorizations

The RPAS service provider collects data on an installation or vessel using a variety of onboard *Payloads*, while adhering to strict *Flight Safety* principles and high standards of professionalism.

To undertake commercial operations with RPAS, the pilot is required to meet the knowledge and competency requirements in respect of advanced operations set

out in Division V of Part IX of the CAR (e.g., sections 901.64 - 901.69). It is important to note that should a foreign RPAS pilot (non-Canadian or permanent resident) be hired to do the work, they will not be able to operate under an Advanced Operations Pilot Certificate unless they obtain a Special Flight Operations Certificate (SFOC).

In the absence of more detailed operating guidelines, RPAS pilots should comply with Part IX of the CAR and take into consideration the recommendations of *Transport Canada TP 15263 - Knowledge Requirements for Pilots of Remotely Piloted Aircraft Systems 250 g up to and including 25 kg, Operating within Visual Line-of-Sight (VLOS), CAP 722: Unmanned Aircraft System Operations in UK Airspace* and *Oil and Gas UK Unmanned Aircraft Systems Operations for Offshore Installations*, as appropriate, in conducting their operations in the *Offshore Area*. In addition, CAA and IOGP may have guidance available. In particular, the RPAS pilot training and competency requirements for working offshore should be adhered to.

7.2 Permission to Operate

The requirements for gaining permission to operate in Canadian airspace are located in Part IX, Division IV and V of the CAR. Unless permitted otherwise by TCA, the basic requirements for RPAS that weigh 25 kg or less should be applied including requirements for VLOS at all times during the flight, operations in controlled airspace, operations near people, operations over people, height restrictions, night operations, multi-tasking and operations with other aircraft in the vicinity.

7.3 Quality Management

A formal quality management system should be in place. RPAS operating companies should hold ISO 9001 certification and the scope should cover all the areas of the business that contribute to offshore activities.

7.4 Training and Competence

Commercial RPAS operations can vary significantly in terms of the training and experience required for an RPAS crew to be considered competent for a specific task. Currently, there are numerous types of RPAS operations that are carried out in an offshore environment, including:

- Aerial photography/survey/security – These operations typically involve flying in an open space away from structures. An example of this would be taking overview photographs of an offshore installation. This task requires a lower level of skill than that required for close inspection flying, as the pilot will have more time and space to react to system anomalies or failures or changes in weather conditions. Nevertheless, the pilot should undertake

additional training in accordance with the operator's requirements and be assessed as competent against an industry approved set of criteria before being deemed competent to carry out offshore aerial photography or survey tasks.

- Inspection operations – These operations account for the majority of RPAS offshore activities. This usually involves flying over water and/or close to or under structures in order to get detailed imagery or data of the installation or vessel. An example would be conducting a close visual inspection of a flare boom. Flying close to structures carries a higher degree of risk as the pilot has less time to react to an unplanned event. There is also a higher probability of encountering turbulent air, the presence of explosive atmospheres and systems anomalies caused by severe magnetic disturbance, loss of GPS, etc. The pilot should therefore receive additional training in accordance with the operator's requirements and be assessed as competent against relevant industry best practices before carrying out offshore inspection operations. These criteria will be more rigorous than those required for aerial photography and survey activities.

Refer to requirements in Part IX of the CAR. Additional guidance is provided in *Oil and Gas UK Unmanned Aircraft Systems Operations for Offshore Installations*.

RPAS service providers should manage and conduct their flying activities in a manner similar to established aviation industry best practices. This includes promulgating the policies, practices and procedures required for RPAS pilots, and support team training, recurrent training, competence and currency requirements and line checks, etc.

The processes for RPAS pilot selection, experience, initial and recurrent type training, currency requirements, competence assessment and record keeping should be determined by the individual RPAS service provider and be embedded in the management system. To this end, the RPAS operations manual should have detailed RPAS type training and recurrent training policies with adequate systems in place to undertake periodic competency checks for each offshore RPAS pilot and *Team Member*.

The RPAS service provider should also maintain up-to-date records of qualifications, training and competence assessments for each individual RPAS pilot/crew member assigned to offshore RPAS duties.

As part of the operator's Declaration of Fitness, processes for training and competency and associated records should be reviewed by an aviation subject matter expert appointed by the operator prior to deploying RPAS teams offshore.

The operator's aviation subject matter expert should use their company aviation auditing standards already in place for fixed wing and rotary wing, generally

applying these to RPAS operations with minor amendments. Airworthiness and maintenance should be performed in accordance with original equipment manufacturer instructions and in accordance with any requirements of Part IX of the CAR (e.g., 901.29, 901.30, 901.31, 901.78).

7.4.1. Selection of RPAS Pilots

The RPAS service provider selection process for employing potential RPAS pilots, engineering, support staff and contractors should follow a structured and well-defined process that is common in the aviation industry for recruiting personnel for training to operate as licensed professionals. Following a successful application, the candidate should proceed to personal and technical interviews, and a practical RPAS flight assessment. To achieve the goal of qualifying as an offshore RPAS pilot, candidates should also be able to demonstrate an aptitude for working and flying RPAS in a hostile environment.

7.4.2. Initial Training and Experience of RPAS Pilots

Operating an RPAS in and around an installation or vessel requires experienced and specifically-trained RPAS pilots. There are many variables to be considered during the planning for and execution of an RPAS operation. Many of these variables can be taught in a benign environment, but several other variables come only from experience and competence gained by flying in and around different structures in a hostile environment.

An individual should have an acceptable level of training and competence prior to flying in offshore environments.

Initially, an offshore RPAS pilot should attend and pass examinations at an RPAS flight training ground school, followed by practical flight assessments conducted by a TCA-qualified flight reviewer in accordance with Part IX of the CAR. The initial training course should include both a theory component and a practical flight assessment component which takes into consideration the physical environmental conditions and operating conditions offshore. There should also be a good understanding of how the RPAS operates in extreme weather (e.g., cold, high winds, gusts, fog). This is critical to the success of an offshore RPAS operation.

Regardless of prior experience, all potential remote pilots are required to obtain a TCA RPAS Pilot Certificate (Advanced Operations) before undertaking specific offshore training and certification. Obtaining this level of training, experience and demonstrated competence is vital to ensure the RPAS is operated in a safe and professional manner at all times.

Refer to Part IX of the CAR (e.g., 901.64) and the additional guidance provided in *Oil and Gas UK Unmanned Aircraft Systems Operations for Offshore Installations*.

7.4.3. Offshore RPAS Training and Competency

The RPAS service provider training system for candidates to advance toward gaining RPAS pilot authorization for undertaking offshore activities should be implemented as noted above. These should be in accordance with the CAR and take into consideration industry best practices in respect of these activities. Before a student is permitted to act as a remote pilot for offshore projects, a ground school and flight syllabus covering advanced offshore flight training (including RPAS flight training for camera and inspection operations) and a formal assessment of competence is required. Training should include:

Ground Training: Hazard awareness and risk management in an offshore environment

- Data collection techniques
- TDG by vessel or air training
- Advanced systems knowledge - flight systems theory
  - GPS multipath
  - GPS vulnerabilities and flight system dependencies (e.g., inertial measurement unit, GPS and interaction with the flight control systems)
  - Accelerometer and gyro errors
  - Magnetic interference influence on flight systems
  - Electromagnetic interference effects
  - Local barometric pressure anomalies and effects
  - Autopilot control theory, Kalman filters and combination effects of sensor degradation
  - Offshore weather and sea influences
  - Advanced data collection techniques

Onshore Flight Training:

- Operations in magnetic interference areas
- Operations in congested areas
- Operations in potentially explosive environments
- Manual flight skills assessments in confined areas and close to structures

Once candidates are assessed by the RPAS service provider as suitable for upgrading to an offshore RPAS pilot, students should undertake further training that includes scenarios that could be expected to be encountered onboard an offshore installation.

Flight Training:

- Advanced manual flight – look-down scenarios, close to structures, all orientations

- Operations around magnetic interference-inducing structures
- Operations under deck and look-down scenarios including GPS-denied areas
- Close visual inspection operations at distances >50 m from pilot position
- Operating in induced turbulence and rotor streaming areas
- Recovery from unexpected conditions or system failures

Less-experienced offshore RPAS pilots should initially be supervised/mentored on-site by an experienced industrial survey/inspection RPAS pilot instructor. This period of supervised work should be carried out in an industrial/commercial survey/inspection environment (either onshore or offshore) before being considered for an offshore PIC role.

Recurrent Training: RPAS pilot recurrent training and line checks should be carried out in accordance with the RPAS service provider standard operating procedures and internal policies.

7.4.4. Minimum Crew Composition and Competence Requirements

For the purposes of offshore surveys and inspections using RPAS, the RPAS service provider should deploy at all times a minimum crew composition of two persons forming the RPAS team, plus one observer provided by the operator. The RPAS team should be comprised of the following individuals:

- Remote pilot (PIC) and a *Payload* specialist; or
- Remote pilot (PIC) and an inspection engineer

The above individuals should be fully qualified and current on recertification training. A team made up of two newly qualified pilots each with less than 10 hours supervised industrial, commercial, survey or inspection flight experience on an airframe type, would not be considered safe for working in an offshore environment.

7.4.5. Visual Observer

To assure safe operations, the RPAS team and aircraft should be visually observed by a responsible person familiar with the installation or vessel and its operational safety requirements. The visual observer should also be the radio link between the RPAS team and persons on the installation or vessel to assure agreed processes are being followed in accordance with the operating procedures and that corrective actions are taken in the event of an incident (e.g., muster, fire) during RPAS operations.

The visual observer should be able to see the RPAS without being immersed in a virtual world which precludes them from spotting other hazards. This means that

first-person view devices[4] or video goggles should not be used while performing visual observer duties.

7.4.6. Fatigue Management

The TCA Fatigue Management Guidelines must be followed for the RPAS Flight Crew and requirements for fatigue management onboard the installation must be adhered to. In the event of a conflict, the more stringent requirement applies.

7.5 RPAS Equipment

The below sections outline considerations for RPAS equipment. Airworthiness and maintenance should also be performed in accordance with original equipment manufacturer instructions and in accordance with any requirements of Part IX of the CAR (e.g., 901.29, 901.30, 901.31 and 901.78).

7.5.1. Rotorcraft Airframe/Load Platform

The choice of RPAS airframe/power plant/load platform configuration for specific tasks is the joint responsibility of the operator and the RPAS service providers and should include the following considerations during the selection process:

- A reliable (reliability data should be available) and safe, fit-for-purpose RPAS system
- The following criteria should be inherent in the selected RPAS system to qualify as fit for purpose for offshore operations:
  - The airframe is of robust design and construction (materials and component selection should be of an acceptable standard).
  - It is capable of sustained flight by aerodynamic means.
  - It is remotely operated either manually or automatically through a ground *Control Station* controlled by the remote pilot.
  - It is reusable.
  - It has robust loss of link capability and resistance to cyber attack.
  - The maximum operating range is accurately defined and formally recorded to ensure, as far as reasonably practicable, that a fly away event is unlikely to occur under normal operating conditions.
  - It is certified for operations in the environment in which it is being used (i.e., a potentially explosive atmosphere or a harsh environment).
  - It holds a manufacturer declaration under section 901.76 of the CAR.
- The RPAS should have flight control and battery redundancy and should be equipped with the following modes and software architecture:
  - Automatic GPS modes (unless being operated in a GPS-denied environment)

[4] A first-person view device is a device that generates and transmits a streaming video image to a *Control Station* display or monitor, giving the RPAS pilot the illusion of flying the aircraft from an onboard pilot's perspective.

  - Automatic height modes
  - Manual backup modes
  - Return to home capability
- The RPAS should have a mobile *Control Station* equipped with manual controls and backup capability when automatic modes are not available to the remote pilot.
- The RPAS should have the ability to be landed in a controlled manner in the event of a single motor/propulsion failure.

7.5.2. Power Plants and Rotor Systems

The power plants (e.g., electrical motors) are critical components and have a direct effect on overall RPAS performance. All power plants used in the RPAS should be routinely and properly maintained as part of the RPAS system maintenance program.

The RPAS systems maintenance program should be fully detailed and held in addition to the operations manual.

Multi-rotor RPAS platforms should be high reliability and possess sufficient redundancy in the propulsion/rotor system to permit continued, fully controlled flight in the event any one power plant becomes inoperative.

The RPAS service provider should provide performance data on the type of power plant being used and how environmental conditions in which the RPAS is being operated affects power plant output. Additionally, this performance data should extend to determination of how usage (i.e., accumulated operating time) reduces power plant performance. This is an important safety factor.

7.5.3. Battery Requirements

Batteries used for powering the RPAS propulsion/rotor system (e.g., electronic speed control), flight control systems (e.g., receivers, transmitters, servos and flight management), *Payload* components (e.g., cameras) and ground stations vary greatly in type, capacity and operating characteristics. Invariably, the batteries used in any RPAS will be susceptible to ambient temperature, impact damage and incorrect charging.

It is therefore imperative that the RPAS service provider's operations manual fully details all battery types used (e.g., lithium polymer (LiPo), NiMH, Li-ion, Alkaline) and the associated safety instructions/precautions for battery management, charging and discharging, packing, carriage by air and sea and battery disposal.

Healthy and fully functioning batteries are integral to ensuring the safe and efficient operation of an RPAS and completing the assigned tasks in a timely

manner. To ensure this, RPAS service providers should have a battery management system in place that, as a minimum, should include the following:

- Battery Inventory – to ensure sufficient batteries are available for the assigned task and to provide accountability for all batteries transported to and used at the work site.
- Battery Charging – LiPo batteries should be handled and managed with great care to ensure they remain undamaged and properly protected during charging and discharging cycles and cell testing. During charging, discharging and cell testing, LiPo batteries should be placed in a robust fire proof enclosure to contain any fire condition that may potentially arise (i.e., due to shorting between cells). There is also a requirement for the area where batteries are stored and maintained to be properly ventilated.
- Battery Health Checks – specific checks (depending on battery type) are carried out to ensure that batteries are in a suitable condition and retain the requisite charge to complete the task safely. Any battery that does not comply with the minimum standards or shows signs of being faulty should be removed immediately, quarantined and properly documented. Under no circumstances should damaged or faulty batteries be used in an RPAS or transported by air.
- Battery Disposal – damaged or underperforming batteries should be removed from the battery line, quarantined and noted on the task inventory.

If a battery is damaged or is found to be faulty, it should be brought to the attention of the person on the installation or vessel responsible for managing disposal of hazardous waste. The installation or vessel should have procedures in place for hazardous waste disposal and these batteries should be fully discharged and brought ashore (by sea) and disposed of by a registered waste collection company in accordance with TDG regulations and onshore waste disposal requirements. The number of times a battery has been charged and discharged should be recorded. If the battery cannot be safely discharged due to damage, it is recommended to submerge the battery in salt water (ocean water) for 72 hours before disposing of it. In the event of a battery emergency (e.g., fire/thermal runaway), battery-specific emergency response equipment (extinguishment and containment) should be readily available on site.

7.5.4. Electronic and Data Capture Requirements

All data collected from the operation of the RPAS should be captured, analyzed and retained for future review to ensure the continual improvement of the safety of the operation. Data capture should always be made in its raw format. Consideration should be given to the following:

- Metadata associated with the imagery should be available.
- Maintenance of the integrity of the raw imagery during the storage process.

- Alterations or amendments to the raw imagery should be stored separate to original raw data image and associated metadata.

When data is transferred from the secure digital card or original hard drive to a central server, the following should be ensured:

- Continuous chain of custody
- Local storage data encryption
- Central storage data encryption
- Once data centrally held, appropriate security policy and backup management

7.6 RPAS Limitations

7.6.1. Visual Conditions for Operations

There are no VMC criteria that apply to RPAS operations, so VLOS should always be applied. An RPAS can be operated safely on the exterior of an installation in weather conditions that are much lower than the VMC minima for manned aircraft.

The key element is that the RPAS is kept within the direct, unaided VLOS of the person flying it and the visual observer (i.e., the remote pilot and visual observer have to be able to see the aircraft at all times, including operations at night). If the aircraft can be seen and controlled safely at night while when flying in a floodlit area for example, there should be no reason to prevent the flight taking place as long as the RPAS can be seen clearly by the crew. Part IX of the CAR has requirements with respect to positional/navigational lighting for night operations.

When nighttime operations are required on the exterior of an installation, adequate lighting should be provided to ensure the pilot has visual contact with the RPAS at all times. Nighttime operations should be in accordance with regulations established by TCA, NAV Canada and the *Regulator* as appropriate to the operation.

RPAS operations in confined spaces such as tanks and voids should be subject to special consideration, risk assessment and rigorous work permit controls, including maintaining a safe distance from any personnel. Visual conditions in these cases will be dependent on the provision of sufficient artificial lighting to allow good visual references to be obtained, to ensure that proper control and monitoring can be maintained throughout the flight duration. If the RPAS team enters a confined space, they should meet all requirements with respect to confined space entry in accordance with the *OHS Regulations*.

7.6.2. Weather Considerations

7.6.2.1. Wind

The operator's adverse weather policy (or established weather limits) is one of the controlling factors for all offshore operations, including RPAS flights.

Due to the extreme physical and environmental conditions encountered in the *Offshore Area*, wind and weather are both critical considerations when performing RPAS operations. The operational envelope should specify the wind limits for the type of RPAS in use and the type of operations being conducted. These limits could be below the established operating limits for the installation or vessel.

If the weather forecast indicates that wind conditions are anticipated to be outside of the RPAS operating limits at some stage during the flying task, the RPAS pilot should land the RPAS 30 minutes prior to the forecasted change. Frequent monitoring of winds during the operations is necessary and should be coordinated with personnel responsible for monitoring the weather onboard the installation or vessel.

7.6.2.2. Precipitation

Rain and moisture can affect some exposed parts of the RPAS and its *Payload*, and it can potentially degrade the quality of the imagery. This is an important consideration for the RPAS pilot when selecting the RPAS system (e.g., airframe and *Payload*) for the specified task and should be fully considered in the risk assessment.

7.7 Record Keeping

Full formal and detailed records of RPAS flights and associated usage, including the permit to work, task details and completed maintenance should be maintained by the RPAS service provider and these requirements should be prescribed in the operations manual.

All RPAS crew members (e.g., pilots, observers, maintainers) should be in possession of a log book that provides a continuous personal record of individual qualifications, regulatory and company authorizations, training, recurrent training, task competencies and flights/tasking carried out.

8.0 Bibliography

1. *CAP 722: Unmanned Aircraft System Operations in UK Airspace, April 2024*
2. *Oil and Gas UK Unmanned Aircraft Systems Operations for Offshore Installations, December 2019*
3. *Transport Canada Advisory Circular (AC) 922-001: Remotely Piloted Aircraft Systems Safety Assurance - Transport Canada, November 2021*
4. *Transport Canada Standard 922- RPAS Safety Assurance – Canadian Aviation Regulations, January 2019*
5. *Transport Canada TP 15263 - Knowledge Requirements for Pilots of Remotely Piloted Aircraft Systems 250 g up to and including 25 kg, Operating within Visual Line-of-Sight (VLOS), June 2019*
6. *Transport Canada Drone Safety (tc.canada.ca/aviation/drone-safety)*

9.0 Appendix A – Sample Content for RPAS Operational Safety Plan

The operational safety plan is an important operational document specific to offshore installations or vessels and should be developed for all RPAS operations. The purpose of the operational safety plan is for all persons involved in the operation to fully understand the safety and communications procedures that an RPAS operations team will follow during the task. The operational safety plan should contain the following details:

1. Introduction
2. RPAS Specifications and Limits
    a. RPAS technical specifications
    b. Limitations and restrictions
3. Operation description
    a. Scope of work(s) to be executed
    b. Required equipment and personnel
    c. Securing the airspace
    d. Take-off and landing sites
    e. Exclusion zones (no-fly zones)
    f. Airborne procedures including details of flight paths
    g. Communication protocol
4. Operations Restricted Access
5. Alarms
    a. Fire and gas release
    b. Blowdown/increased flare rate drill
6. Preventive Matters
    a. Prop failure
    b. Loss of *Payload*/dropped object risk
    c. Battery failure
    d. Loss of communication link
    e. Resistance to magnetic disturbances and anomalies
    f. Log file recording

10.0 Appendix B – Sample Content for RPAS Pilot Operations Manual

Part A – General

1. Organization and Responsibility
    a. Scope
    b. Purpose
    c. Company structure and accountable managers (include organogram)
    d. RPAS services description
    e. RPAS equipment overview
    f. Regulations and guidance
        i. Aviation regulatory compliance
        ii. C-NLOPB/CNSOPB/TC guidance
    g. Operations and training personnel
        i. Operations director/operations manager
        ii. Remote pilot
        iii. RPAS camera/*Payload* specialist
        iv. Remote pilot instructor
2. Company Authorizations
    a. Operation description
    b. TC/NAV Canada Permission for Aerial Work
    c. Other permissions (if applicable)
    d. Company personnel training and competency requirements
    e. Company personnel medical requirements and certification (if applicable)
3. Risk Analysis Model
    a. Policy
    b. Risk assessment
    c. Method statement
    d. Safety plan
4. Management System (or equivalent)
5. Quality Control System
    a. ISO 9001:2015
6. Rest Time Policy and *Human Factors*
    a. Policy
    b. Human Factors
7. General Operating Procedures and Restrictions
    a. Remote pilot basic requirements
        i. Remote pilot qualification
        ii. Conduct
        iii. Remote pilot specific duties
        iv. Competency
    b. Met assessment
    c. Pre-flight duties
    d. Airspace management
    e. Flight procedures
    f. VLOS

   g. RPAS system basic requirements
   h. Checklist procedures
   i. Checklist information
   j. RPAS team operations
   k. Loss of link
   l. Airworthiness
   m. Post-flight duties
   n. Tech log
   o. Logbook
8. Accidents and Incidents
   a. Incident reporting
   b. Post-accident management
   c. Remote pilot grounding
9. Types of Operations
   a. Description
   b. VLOS
   c. Authorized operations

Part B – RPAS System Manual

1. General
2. Checklists
3. Description of the RPAS
   a. Remotely Piloted Aircraft Systems
   b. Mobile *Control Station*
   c. *Payloads*
   d. Batteries and chargers
   e. Transport case
4. RPAS Operation
   a. General safety
   b. Flight modes
      i. GPS mode
      ii. Height mode
      iii. Manual mode
   c. Automated system checks
   d. Emergency modes
   e. RPAS setup procedures
   f. Mission *Control Station* setup procedures
   g. Flight phase
      i. Launch procedure
      ii. Mission procedure
      iii. Recovery procedure
   h. Visual and acoustic warnings
   i. Limitations information
5. Status Display
   a. Functions

b. Emergency modes
c. Display menus

6. Waypoint Navigation
   a. Automation
   b. Mode redundancy
   c. Geo-reference
   d. GPS
   e. *Payload* control
   f. RVT *Payload* control

Part C - Authorized Operations

1. Offshore Installation Inspections
   a. Introduction
      i. General
      ii. Applicable documents
      iii. Onshore inspection
      iv. Offshore inspection
2. Standard Operating Procedures
   a. Preparation
      i. RPAS minimum serviceability
      ii. Infrastructure study
      iii. Equipment and inventory
      iv. Operations assignment
      v. Safety plan
      vi. Risk assessment
      vii. Method statement
   b. Inspection types
      i. Onshore
      ii. Offshore

Part D - Remote Pilot Training

1. General
   a. Policy
   b. Objectives
   c. Applicable documents
   d. Approved training RPAS
   e. Instructional staff duties and responsibility
   f. Pilot instructor
   g. Trainee evaluation
2. Ground School
   a. General
   b. Objectives
      i. Course description
      ii. Course contents
      iii. Supplementary training

   c. C-NLOPB/CAPP minimum training
      i. Basic Survival Training
      ii. Helicopter Underwater Escape Training/Helicopter Underwater Escape Breathing Apparatus Training
      iii. Offshore medical
      iv. Fall arrest, confined space entry training, Hydrogen Sulphide Training, etc., as required, based on task
3. Camera Operation Training
   a. RPAS team operations
   b. Remote viewing terminal (RVT) - If required/permitted
   c. Communications procedure
4. Industry-specific RPAS Inspection Training
   a. *Payload* operations
5. Initial RPAS Training
   a. General
   b. Training RPAS familiarization
   c. Emergency procedures
   d. Degraded mode RPAS flight training
   e. GPS
   f. Height
   g. Manual
   h. Initial RPAS training flight test
6. Advanced RPAS Training
   a. General
   b. Inspections training against infrastructure
   c. Task-specific flight training (e.g., surveillance, photographic, infrastructure inspection)
   d. Advanced RPAS training flight test
7. RPAS Inspection Type Training
   a. Inspection RPAS familiarization
      i. Payload
      ii. Circuits
      iii. Modes - GPS; height; manual
      iv. Emergency
   b. Inspection RPAS type training against structures
   c. Type training flight test
   d. Remote pilot consolidation training
   e. Scope
   f. RPAS team ops
   g. Mentor program

Part E - RPAS Maintenance and Servicing

1. Policy
   a. RPAS maintenance policy
   b. RPAS maintenance schedules and periodicity

2. RPAS Accountable Managers and Technicians
    a. Independent checks
    b. Extensions and unserviceable equipment
3. Technical Log
4. Minimum Equipment List
5. Spares Stores and Inventories
6. RPAS Cleaning
7. Batteries
    a. Inspection procedures
    b. Storage and disposal
    c. TDG requirements
    d. Charging practices and precautions
    e. Tracking and Inventory arrangements
8. Routine Maintenance
    a. Mission *Control Station*
    b. Other inspections equipment